

WHAT IS CLAIMED IS:

1. A marking method comprising the steps of:
  - preparing a marking object;
  - 5       converging, into the marking object, a laser beam having a wave length range so chosen that the laser beam can transmit through a material forming the marking object, and then effecting a multiple photon absorption; and
  - moving a converging position of the laser beam, in a manner such that an area, whose refractive index is changed due to the multiple photon absorption,
  - 10   can form a diffraction pattern capable of diffracting a visible light.
2. A marking method according to claim 1, wherein the diffraction pattern is Bragg diffraction pattern.
- 15 3. A marking method according to claim 1, wherein the step of moving the converging position of the laser beam comprises the steps of:
  - moving the converging position in a manner such that a first pattern is formed and arranged along a virtual plane;
  - moving the converging position in a manner such that a second pattern is
  - 20   formed, said second pattern being obtainable by translating the first pattern in a normal direction of the virtual plane.
4. A marking apparatus comprising:
  - a stage for mounting a marking object;
  - 25       a light source for producing a laser beam having a wavelength range so chosen that the laser beam can transmit through a material forming the marking object;

an optical system for converging the laser beam emitted from the light source into the marking object, then effecting a multiple photon absorption; and  
a moving mechanism for moving the converging position in a manner such that characteristic-changed portions formed by virtue of the multiple photon  
5 absorption, will form, in the converging positions of the laser beam, a diffraction grating capable of diffracting a visible light.

5. An optical element formed by a material capable of transmitting therethrough a visible light and containing a pattern consisting of different portions having  
10 different optical properties, wherein said pattern is capable of diffracting a visible light.

6. A marking method comprising:  
a first step of irradiating a marking object by a pulse laser beam while at  
15 the same time changing NA of an objective lens and an energy per pulse, thereby forming a characteristic-changed area by virtue of move of a light converging spot;

a second step of obtaining a relationship among the length of the characteristic-changed area, an NA and an energy per pulse;  
20 a third step of determining the length of a characteristic-changed area to be formed;

a fourth step of determining an NA and an energy per pulse, in accordance with the relationship obtained in the second step, also in accordance with the length of a characteristic-changed area to be formed; and

25 a fifth step of converging a laser beam on the marking object to form a characteristic-changed area therein, by using the determined NA and the determined energy per pulse.

7. A marking method according to claim 6, wherein the first step uses a laser beam to conduct an exposure which is continued until the length of a characteristic-changed area becomes saturated, thereby forming a characteristic-  
5 changed area having a saturated length.